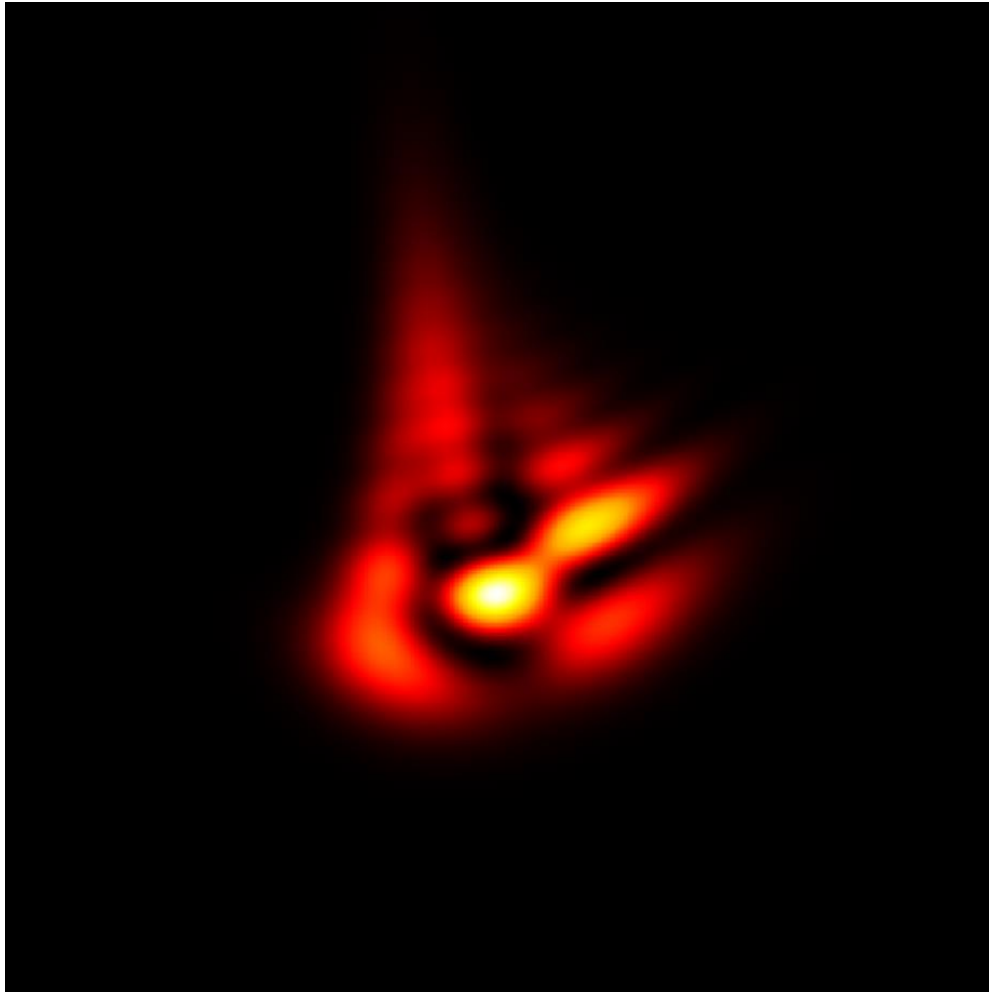


# Aberration Effects on Focused Modes from a Fiber Source

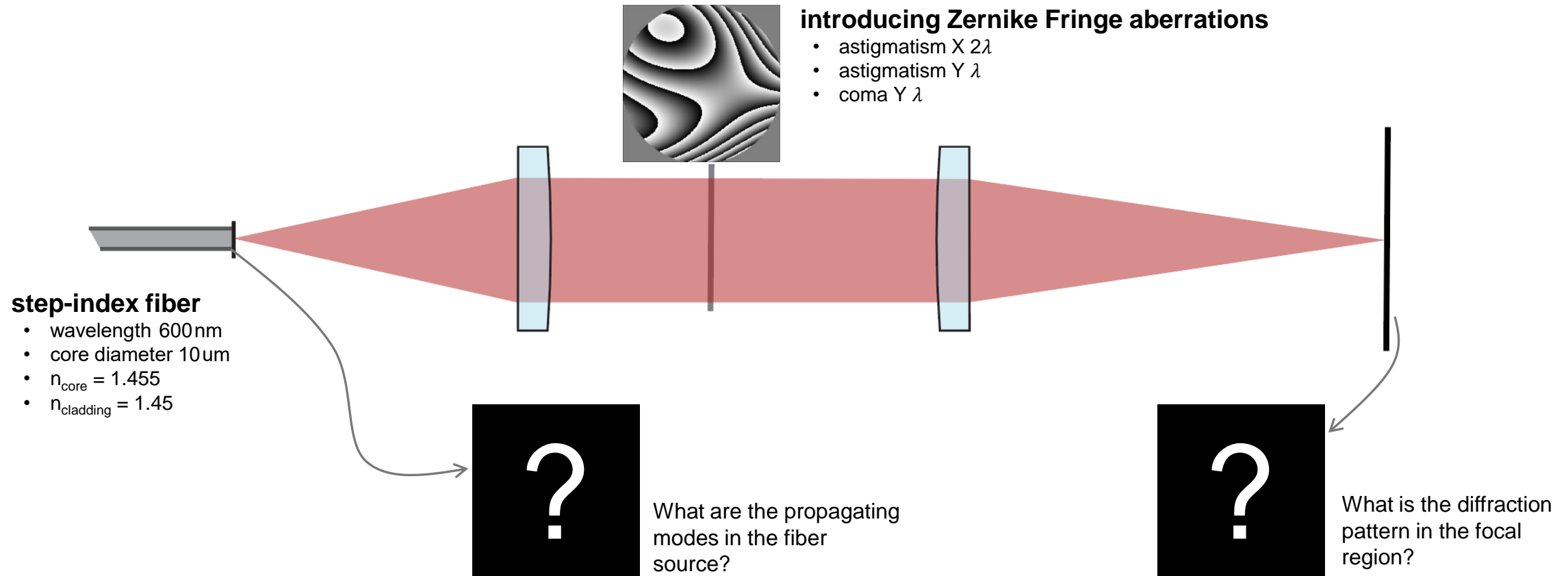
# Abstract

---

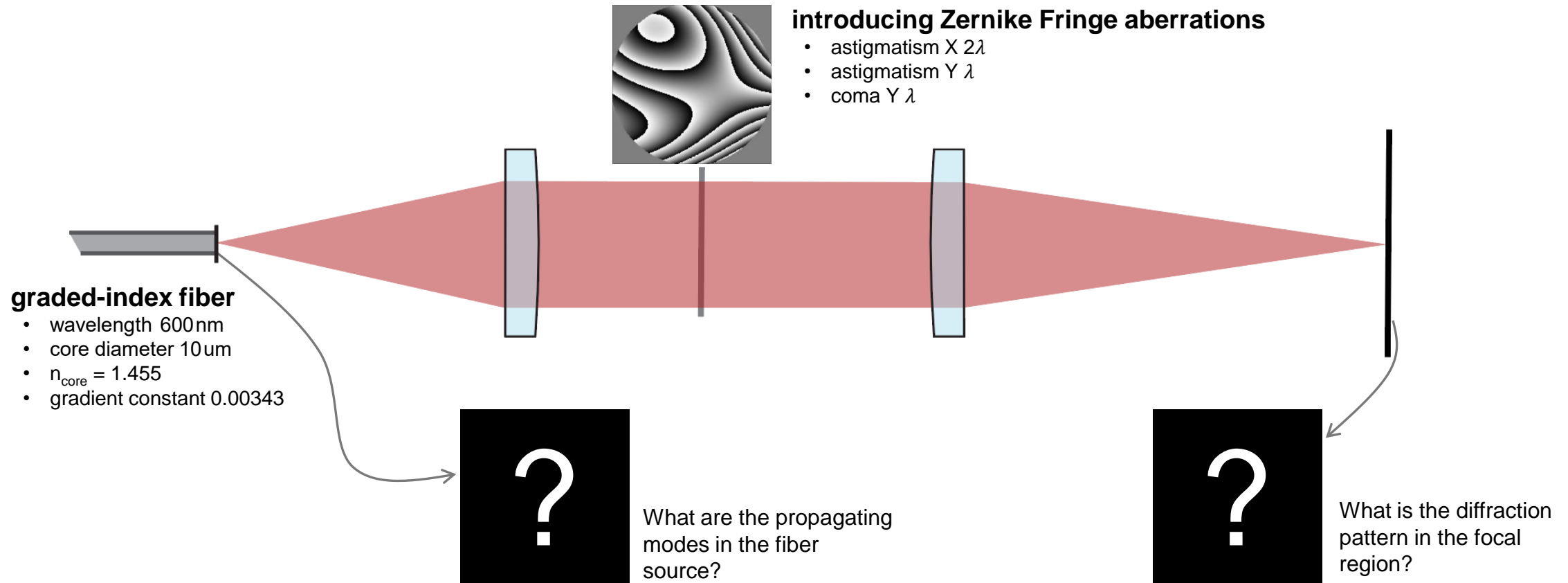


Fibers are widely used as sources in optical systems. Investigating the aberration effects of an optical system on the propagation of the fiber modes is therefore of interest. In this use case we employ the fast physical optics engine in VirtualLab Fusion to demonstrate how the shape of a set of modes generated by either a step- or graded-index fiber, and the total field resulting from their combination, is affected by propagation through an aberrated optical system.

# Modeling Task with a Step-Index Fiber



# Modeling Task with a Graded-Index Fiber

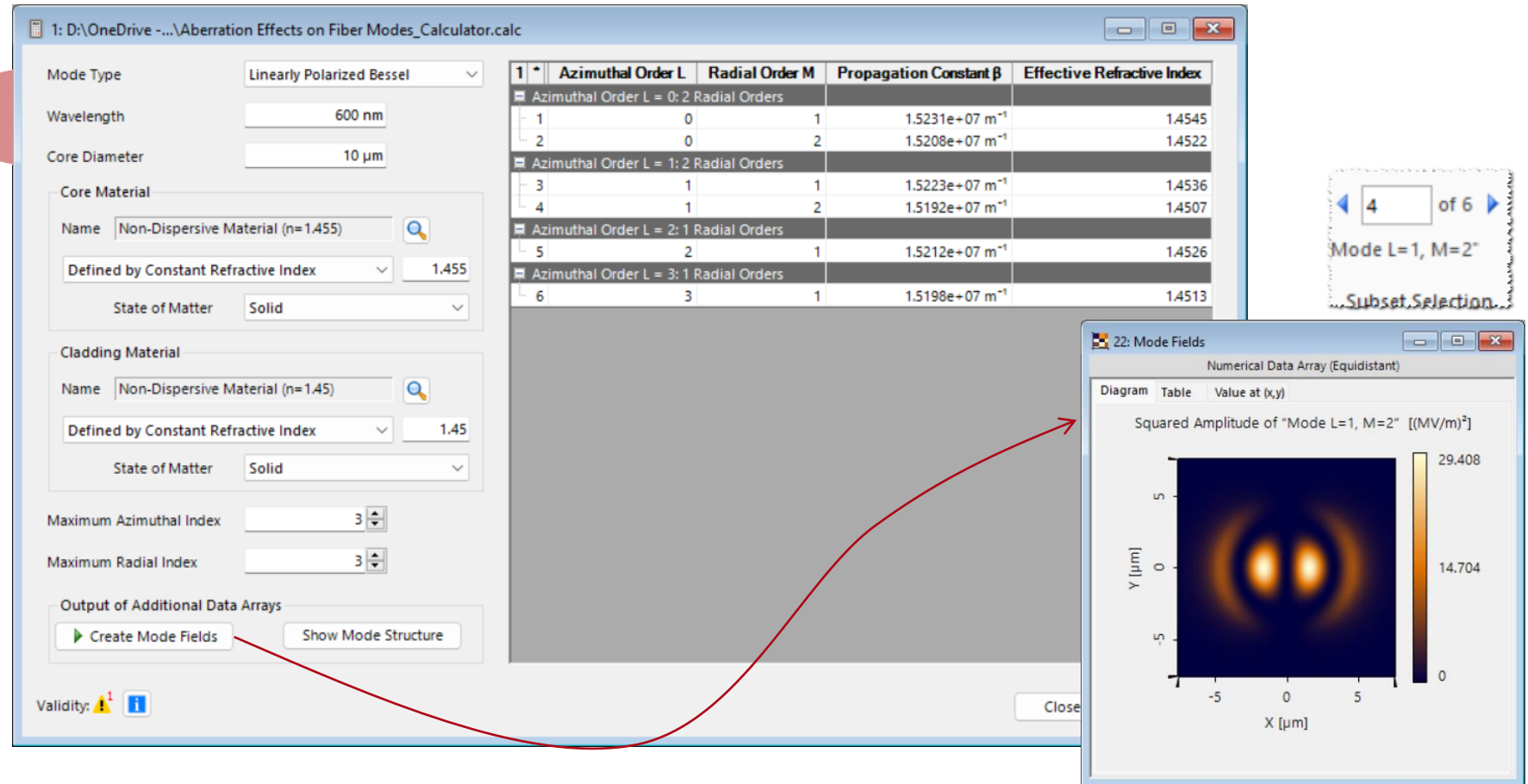


# Linearly Polarized Mode Calculator

## step-index fiber

- wavelength 600 nm
- core diameter 10  $\mu\text{m}$
- $n_{\text{core}} = 1.455$
- $n_{\text{cladding}} = 1.45$

This calculator gives the propagation constants and mode fields of all existing linearly polarized (LP) modes.

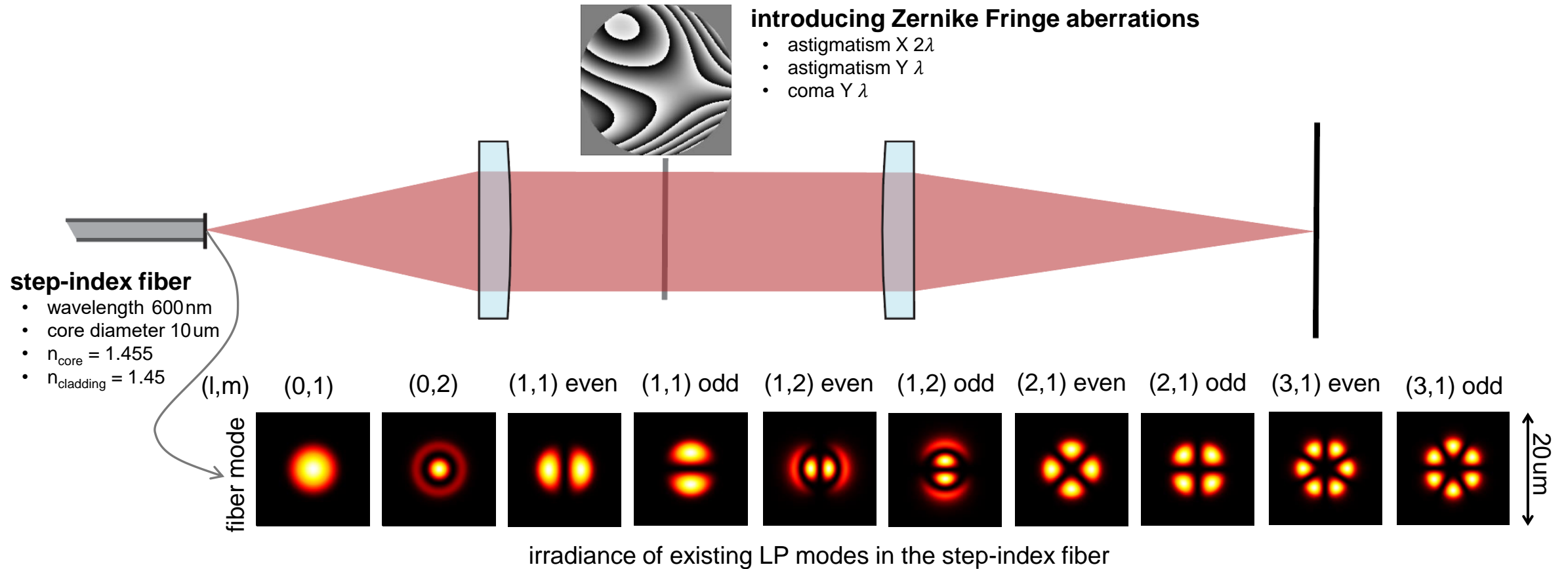


For further information:

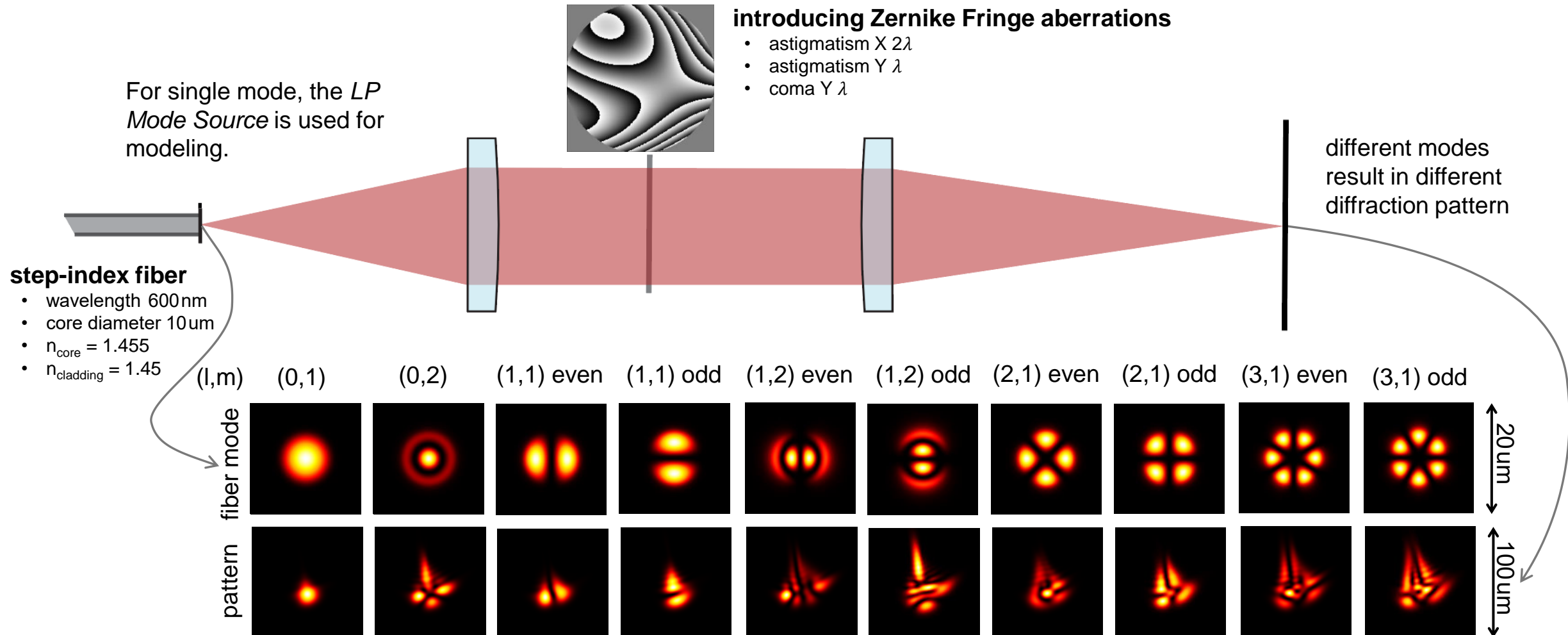
[LP Fiber Mode Calculator](#)

fields of all LP modes

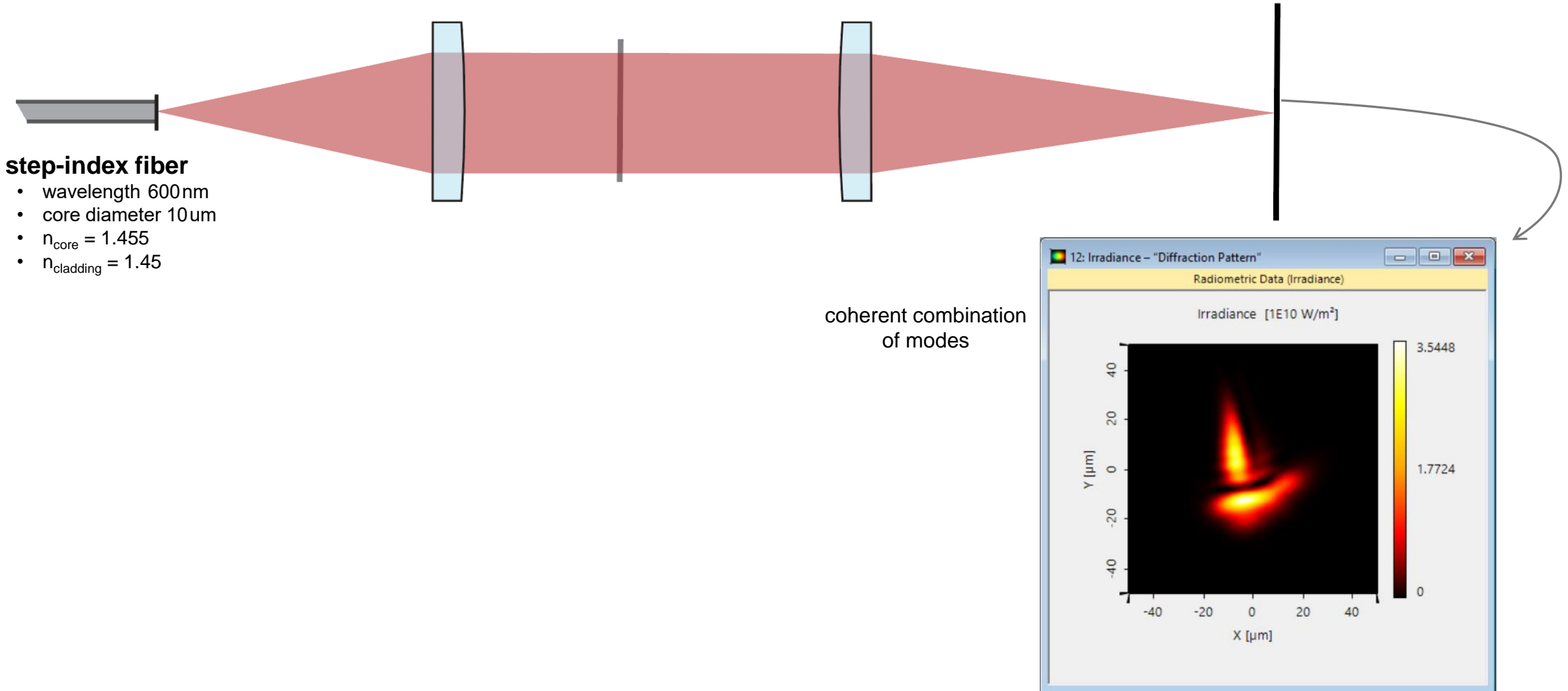
# Source of Fiber Modes



# Diffraction Patterns of Step-Index Fiber



# Coherent Summation of all Modes – Step-index Fiber



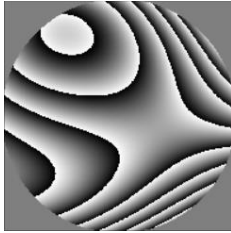


# Diffraction Patterns of GRIN Fiber

For single mode, the *LP Mode Source* is used for modeling.

## graded-index fiber

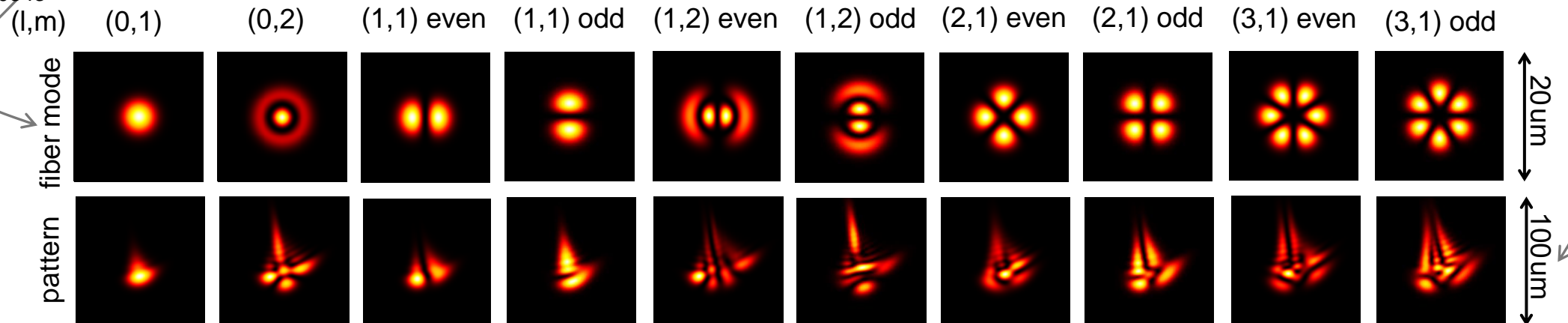
- wavelength 600nm
- core diameter 10 $\mu$ m
- $n_{\text{core}} = 1.455$
- gradient constant 0.00343



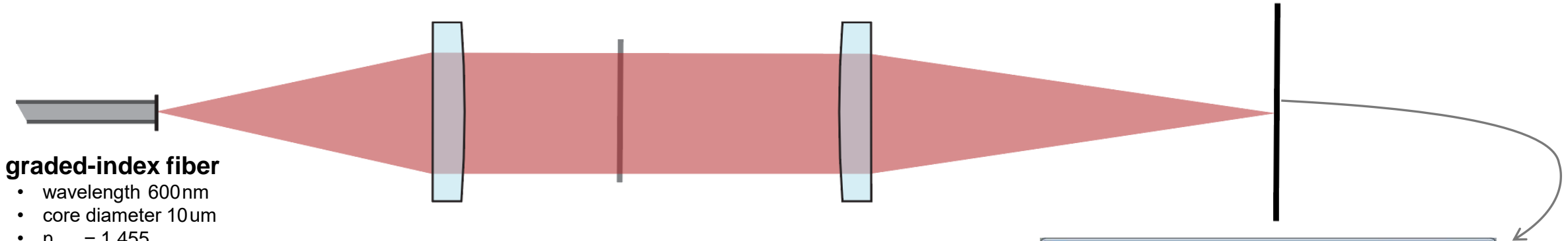
## introducing Zernike Fringe aberrations

- astigmatism X  $2\lambda$
- astigmatism Y  $\lambda$
- coma Y  $\lambda$

different modes  
result in different  
diffraction pattern



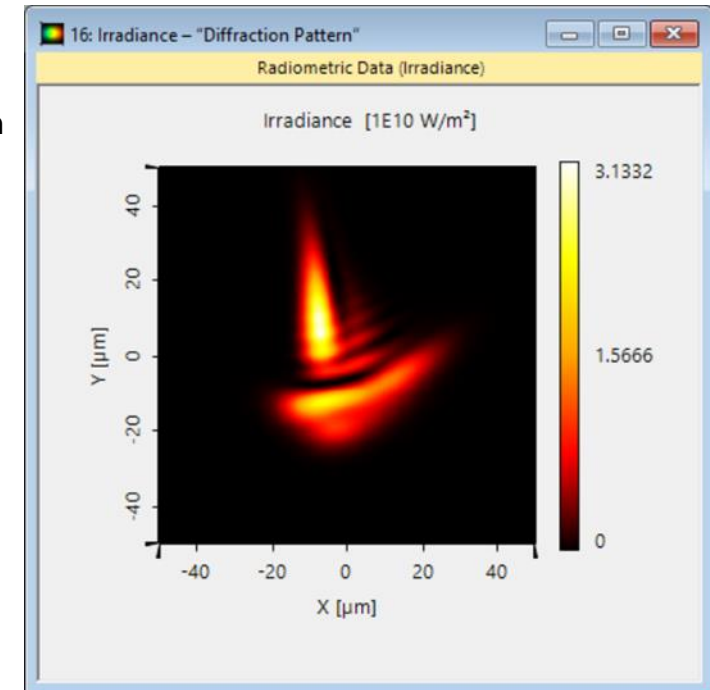
# Coherent Summation of all Modes – GRIN Fiber



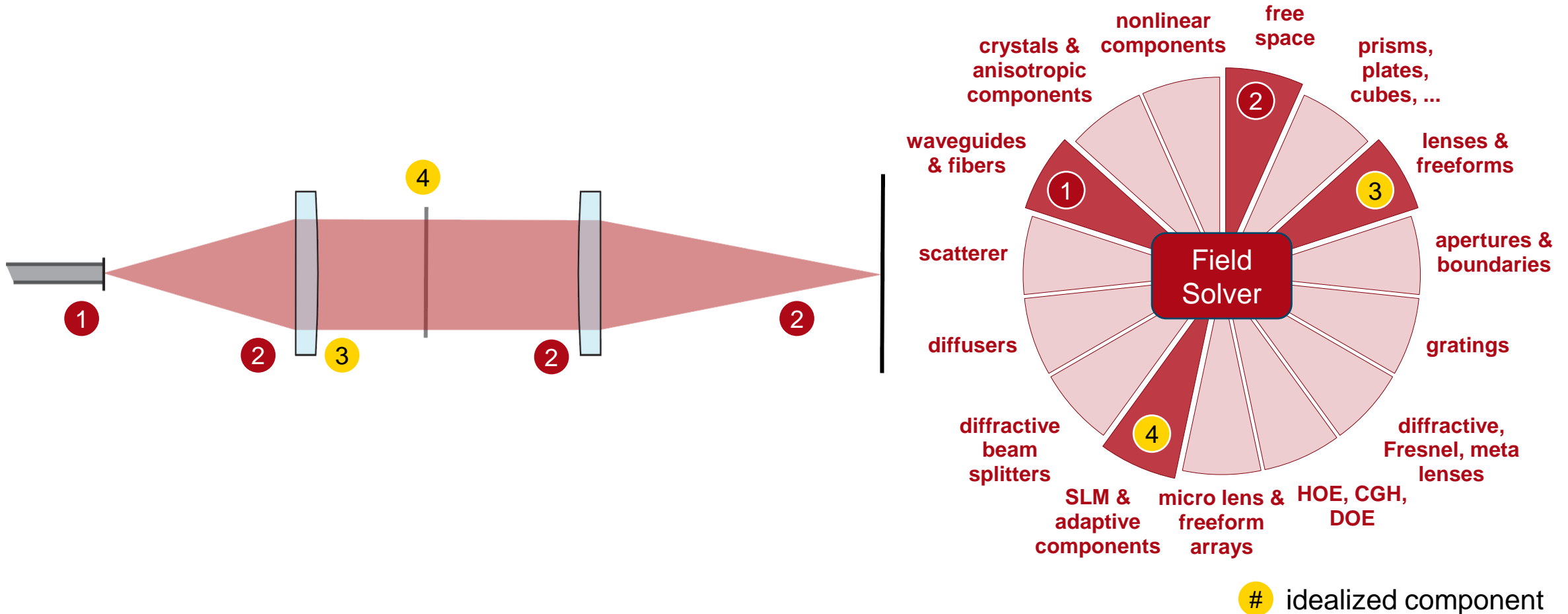
## graded-index fiber

- wavelength 600nm
- core diameter 10 $\mu$ m
- $n_{\text{core}} = 1.455$
- gradient constant 0.00343

coherent combination  
of modes



# VirtualLab Fusion Technologies



# Document Information

---

title	Aberration Effects on Focused Modes from a Fiber Source
document code	FCP.0006
document version	1.2
software edition	VirtualLab Fusion Basic
software version	2024.1 (Build 1.132)
category	Application Use Case
further reading	<ul style="list-style-type: none"><li>- <a href="#">Fiber Mode Calculator</a></li><li>- <a href="#">Few-Mode Fiber Coupling under Atmospheric Turbulence</a></li></ul>